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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/849,964	05/19/2004	Shriram Ramanathan	42P19016	8073

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EXAMINER	
DINH, BACH T	

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4128	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/849,964	RAMANATHAN ET AL.	
	Examiner	Art Unit	
	Bach T. Dinh	4128	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05/19/2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-25* is/are rejected.

7)☒ Claim(s) *19* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *05/19/2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *03/06/2006*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Summary

1. This is the initial Office Action based on the 10/849,964 application filed on May 19, 2004.

2. Claims 1-25 are currently pending and have been fully considered.

Claim Objections

3. Claim 19 is objected to because of the following informalities:

a. At line 1 of claim 19, claim 19 is dependent on itself. For examination, claim 19 is interpreted to be dependent on claim 17.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1-3, 5-9, 11-13, 16-18, and 20 are rejected under 35 U.S.C. 102(e) as being anticipated by FUKITANI et al. (US 2006/0032526).

With respect to claim 1, FUKITANI et al. teach a thermoelectric conversion material having a structure and a manufacturing method thereof. Figure 8 illustrates a thermoelectric generating device wherein conversion material sections 103 and 105 having nano-wires 102 of p-type and nanowires 104 of n-type, both are formed in a porous body 101. Electrodes 106 and 107 are connected to the p-type and n-type material sections, respectively. Temperature difference between the upper electrode 108 and the lower electrodes 106 and 107 causes generation of electric power [0114]. The upper electrode 108 is interpreted as claimed first electrode, the lower electrode 107 is interpreted as the claimed second electrode with p-type nano-wires 102 are equivalent to the claimed nano-wire that extends between the first and second electrode.

Alternatively, the lower electrode 106 is interpreted as the claimed first electrode and the upper electrode 108 is interpreted as the claimed second electrode with n-type nano-wires 104 are equivalent to the claimed nano-wire that extends between the first and second electrode. Claimed dielectric material is the porous body 101 that is deposed between the upper and lower electrode.

Regarding claim 2, FUKITANI et al. teach that n-type thermoelectric nano-wires are made of BiTe; alternatively, p-type thermoelectric nano-wires are made of BiSb [0112]. Therefore, the teaching of FUKITANI et al. anticipates the claimed bismuth containing material nano-wire of current application.

With respect to claim 3, FUKITANI et al. teach that n-type and p-type nano-wires are deposited within a porous body 101 [0114]; therefore, the teaching of FUKITANI et al. anticipates the claimed porous dielectric material of current application.

Regarding claim 5, the upper electrode 108 or claimed first electrode is negatively charged due to its connection with the lower electrode 106 which is connected to the negative terminal of a power supply; the lower electrode 107 or claimed second electrode is positively charged for it is connected to the positive terminal of a power supply [0115]. Alternatively, the lower electrode 106 or claimed first electrode is negatively charged for it is connected to the negative terminal of power supply; the upper electrode 108 or claimed second electrode is positively charged due to its connection with the lower electrode 107 which is connected to the positively terminal of a power supply [0115].

With respect to claim 6, FUKITANI et al. teach a thermoelectric conversion material having a structure and a manufacturing method thereof. Figure 8 illustrates a thermoelectric generating device wherein conversion material section 103 and 105 having nano-wires 102 of p-type and nanowires 104 of n-type, both are formed in a porous body 101. Electrodes 106 and 107 are connected to the p-type and n-type material sections, respectively. An upper electrode 108 that is in higher temperature than said lower electrodes 106 and 107. Temperature difference between the upper electrode 108 and the lower electrodes 106 and 107 causes generation of electric power [0114]. FUKITANI et al. teach that higher temperature electrode 108 and lower temperature electrode 106 and

107 are desirably supported on a support plate [0086]. This support plate is interpreted as the claimed microelectronic die, with the microelectronic die closer to the higher temperature electrode 108 has higher heat dissipation rate than microelectronic die close to the lower temperature electrodes 106 and 107. The upper electrode 108 is interpreted as claimed first electrode, the lower electrode 107 is interpreted as the claimed second electrode with p-type nano-wires 102 are equivalent to the claimed plurality of nano-wires that extend between the first and second electrode. Claimed dielectric material is the porous body 101 that is deposed between the upper and lower electrode.

Regarding claim 7, electrode 108 is designated higher heat dissipation rate area and electrodes 106 and 107 are designated lower heat dissipation rate area. According to figure 8 of FUKITANI et al., lower temperature electrodes 106 and 107 are separated and both are connected to higher temperature electrode 108 via nano-wires. It is apparent from the illustration that the higher temperature electrode 108 is connected to more nano-wire than individual lower temperature electrodes 106 and 107. Therefore, this teaching anticipates the claimed limitation "...said nano-wires are dispersed in a higher density proximate said at least one higher heat dissipation rate area" of current application.

With respect to claim 8, FUKITANI et al. teach that n-type thermoelectric nano-wires are made of BiTe; alternatively, p-type thermoelectric nano-wires are made of BiSb [0112]. Therefore, the teaching of FUKITANI et al. anticipates the claimed bismuth containing material nano-wire of current application.

Regarding claim 9, FUKITANI et al. teach that n-type and p-type nano-wires are deposited within a porous body 101 [0114]; therefore, the teaching of FUKITANI et al. anticipates the claimed porous dielectric material of current application.

With respect to claim 11, the upper electrode 108 or claimed first electrode is negatively charged due to its connection with the lower electrode 106 which is connected to the negative terminal of a power supply; the lower electrode 107 or claimed second electrode is positively charged for it is connected to the positive terminal of a power supply [0115]. This teaching anticipates the claimed limitations of current application.

Regarding claim 12, FUKITANI et al. teach forming an aluminum-silicon mixture film that contained 50 atomic % of silicon relative to the sum amount of aluminum and silicon by magnetron sputtering; the aluminum-silicon mixture film is equivalent to the claimed dielectric material. Then treated said aluminum-silicon mixture film in 5 wt% phosphoric acid for selectively etching the aluminum material to form a porous body, which is equivalent to the claimed nano-scale opening. Then BiTe or BiSb were electrode-deposited on the porous body to form n-type and p-type thermoelectric nano-wires, respectively [0112]. The formed nano-wires are electrically connected to electrodes to form thermoelectric device as illustrated in example 4 (claim 20, figure 8); electrically connecting nano-wires and surrounding matrix to electrodes is equivalent to the limitation "...disposing dielectric material between first and second electrode wherein

said first and second electrodes contact at least on nano-wire" of current application. High temperature electrode 108 is interpreted as the first electrode and low temperature electrode 106 is interpreted as the second electrode. Alternatively, low temperature electrode 107 is interpreted as the first electrode and high temperature electrode 108 is interpreted as the second electrode.

With respect to claim 13, FUKITANI et al. teach that n-type and p-type nano-wires were formed by electrode-depositing BiTe and BiSb, respectively, on the porous body [0112].

Regarding claim 16, FUKITANI et al. teach attaching the silicon substrate with p-type thermoelectric material and the silicon substrate with n-type thermoelectric material to form a thermoelectric conversion device as shown in figure 8 [0112]. Said thermoelectric device comprises an upper electrode 108, which is interpreted as the first electrode and lower electrodes 106 and 107, in which 107 is interpreted as the second electrode. Said upper electrode 108 is negatively charged because it is connected to lower electrode 106 which is connected to the negative terminal of a power supply. Second electrode 107 is connected to the positive terminal of a power supply. Alternatively, lower electrode 106 is interpreted as claimed first electrode for it is connected to the negative terminal of a power supply; upper electrode 108 is claimed second electrode for it is connected to lower electrode 107 which is connected to a positive terminal of a power supply [0115].

With respect to claim 17, FUKITANI et al. teach forming an aluminum-silicon mixture film that contained 50 atomic % of silicon relative to the sum amount of aluminum and silicon by magnetron sputtering. Then treated said aluminum-silicon mixture film in 5 wt% phosphoric acid for selectively etching the aluminum material to form a porous body, which is equivalent to the claimed porous dielectric material and opening in said porous body. Then BiTe or BiSb were electrode-deposited on the porous body to form n-type and p-type thermoelectric nano-wires, respectively [0112]. The formed nano-wires are electrically connected to electrodes to form thermoelectric device as illustrated in example 4 (claim 20, figure 8). High temperature electrode 108 is interpreted as the first electrode and low temperature electrode 106 is interpreted as the second electrode. Alternatively, low temperature electrode 107 is interpreted as the first electrode and high temperature electrode 108 is interpreted as the second electrode. It is inherent from the teaching that at least one nano-wire contacts with first electrode and second electrode when said porous dielectric material is disposed between first and second electrodes.

Regarding claim 18, FUKITANI et al. teach that n-type and p-type nano-wires were formed by electrode-depositing BiTe and BiSb, respectively, on the porous body [0112] and therefore anticipate the limitation of current application.

With respect to claim 20, FUKITANI et al. teach attaching the silicon substrate with p-type thermoelectric material and the silicon substrate with n-type thermoelectric material to form a thermoelectric conversion device as shown in figure 8 [0112]. Said

thermoelectric device comprises an upper electrode 108, which is interpreted as the first electrode and lower electrodes 106 and 107, in which 107 is interpreted as the second electrode. Said upper electrode 108 is negatively charged because it is connected to lower electrode 106 which is connected to the negative terminal of a power supply. Second electrode 107 is connected to the positive terminal of a power supply. Alternatively, lower electrode 106 is interpreted as claimed first electrode for it is connected to the negative terminal of a power supply; upper electrode 108 is claimed second electrode for it is connected to lower electrode 107 which is connected to a positive terminal of a power supply [0115].

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. Claim 4, 10, 14-15, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over FUKITANI et al. (US 2006/0032526) as applied to claims 1-3, 6-9, 12-13, and 17-18 above in view of FLEURIAL et al. (US 2003/0047204).

Regarding claims 4, and 10 FUKITANI et al. teach all the limitations of claims 1-3, and 6-9 but fail to teach porous dielectric material comprises porous alumina; instead, the silicon oxide porous dielectric material is formed by removing aluminum from the aluminum-silicon starting material [0025] [0028].

FLEURIAL et al. teach a thermoelectric device that operates to create energy based on temperature difference, or conversely, create a temperature difference based on applied energy. Said thermoelectric device contains a plurality of Bi_2Te_3 thermoelectric legs or thin nanoscale wires that are formed within a template of porous alumina [0012-0014] [0017].

Because both FUKITANI et al. and FLEURIAL et al. teach a nanowire containing thermoelectric device that creates energy based on temperature difference, one of ordinary skill in the art would have found it obvious to substitute the silicon oxide porous material of FUKITANI et al. for the porous alumina material of FLEURIAL et al. to achieve the predictable result of converting the temperature difference between electrodes to create electrical energy.

Alternatively, FUKITANI et al. teach a thermoelectric conversion material. FLEURIAL et al. teach manufacturing a chip 499, which includes both a thermoelectric device 500, and other operative structures 510, such as a sensor part 520, a microprocessor part 522 and a communication part 524, on the chip (figure 5). FLEURIAL et al. also teach

incorporating said chip into a thermoelectric generator, or a micro cooler [0028]; therefore, one of ordinary skill in the art would have been motivated to incorporate the thermoelectric conversion material of FUKITANI et al. to improve the chip in a thermoelectric generator taught by FLEURIAL et al.

With respect to claims 14-15, and 19 FUKITANI et al. teach all the limitations of claims 12-13, and 17-18 but fail to teach disposing a porous dielectric material and said porous dielectric material is porous alumina.

FLEURIAL et al. teach a thermoelectric device that operates to create energy based on temperature difference, or conversely, create a temperature difference based on applied energy. Said thermoelectric device is realized by forming a plurality of Bi_2Te_3 thermoelectric elements within a porous alumina substrate that has a plurality of holes (claims 20-21, 31, 36-37).

Because both FUKITANI et al. and FLEURIAL et al. teach a nanowire containing thermoelectric device that creates energy based on temperature difference, one of ordinary skill in the art would have been motivated to substitute the silicon oxide porous material in the method of FUKITANI et al. for the equivalent porous alumina material in the method of FLEURIAL et al. to achieve the predictable result of forming a thermoelectric device that creates energy based on temperature difference.

9. Claims 21-23, 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over MCKINNELL et al. (US 2004/0145049) in view of FUKUTANI et al. (US 2006/0032526).

Regarding claim 21, MCKINNELL et al. teach a micro-fabricated device comprising of a substrate disposed on a support structure. Said substrate is coupled to said support structure by a thermally isolating structure comprising of at least one n-doped region, at least one p-doped region that is separated from said n-doped region and an electrical interconnect connecting said n-doped region and said p-doped region, whereby an intergrated thermoelectric device is formed (claim 1, figure 1). Said thermoelectric device can be use for selective heating or cooling functions within an electronic device such as computer system, video game, MP3 player, cellular phone and PDA [0038] (claim 21). It is conventional that said computer system, video game, or MP3 player have a housing with an input device, such as keyboard, and display device, such as monitor. Said support structure including the substrate is interpreted as the claimed external structure of current application. However, MCKINNELL et al. fail to teach a first electrode, a second electrode, a dielectric material diposed between the first and second electrodes and at least one nano-wire extends between said first and second electrodes.

FUKITANI et al. teach a thermoelectric conversion material having a structure and a manufacturing method thereof. Figure 8 illustrates a thermoelectric generating device wherein conversion material sections 103 and 105 having nano-wires 102 of p-type and nanowires 104 of n-type, both are formed in a porous body 101. Electrodes 106 and 107 are connected to the p-type and n-type material sections, respectively. Temperature difference between the upper electrode 108 and the lower electrodes 106 and 107 causes generation of electric power [0114]. The upper electrode 108 is interpreted as claimed

first electrode, the lower electrode 107 is interpreted as the claimed second electrode with p-type semiconductor material nano-wires 102 are equivalent to the claimed nano-wire that extends between the first and second electrode. Alternatively, the lower electrode 106 is interpreted as the claimed first electrode and the upper electrode 108 is interpreted as the claimed second electrode with n-type nano-wires 104 are equivalent to the claimed nano-wire that extends between the first and second electrode. Claimed dielectric material is the porous body 101 that is deposed between the fist and second electrodes. The thermoelectric generating device of FUKITANI et al. is equivalent subsections of the micro-fabricated device of MCKINNEL et al. Comparing figure 8 of FUKITANI et al. and figure 1a of MCKINNEL et al., p-type material section 103 and n-type material section 105 of FUKITANI et al. are equivalent to the n-doped 152 and p-doped 154 regions of MCKINNEL et al., respectively. Upper electrode 108 and lower electrodes 106 and 107 are equivalent to coupling conductors 156 and segment conductors 158 of MCKINNEL et al. Because both MCKINNEL et al. and FUKITANI et al. teach methods of manufacturing thermoelectric device, one of ordinary skill in the art would have found it obvious to substitute the thermoelectric conversion material of FUKITANI et al. for the micro-fabricated device of MCKINNEL et al. to achieve the predictable result of selective heating or cooling thermally isolated structure within the electronic devices of MCKINNEL et al.

With respect to claim 22, FUKITANI et al. teach that n-type and p-type nano-wires were formed by electrode-depositing BiTe and BiSb, respectively, on the porous body [0112] and therefore anticipate the limitation of current application.

Regarding claim 23, FUKITANI et al. teach that n-type and p-type nano-wires are deposited within a porous body 101 [0114]; therefore, the teaching of FUKITANI et al. anticipates the claimed porous dielectric material of current application.

With respect to claim 25, FUKITANI et al. teach attaching the silicon substrate with p-type thermoelectric material and the silicon substrate with n-type thermoelectric material to form a thermoelectric conversion device as shown in figure 8 [0112]. Said thermoelectric device comprises an upper electrode 108, which is interpreted as the first electrode and lower electrodes 106 and 107, in which 107 is interpreted as the second electrode. Said upper electrode 108 is negatively charged because it is connected to lower electrode 106 which is connected to the negative terminal of a power supply. Second electrode 107 is connected to the positive terminal of a power supply. Alternatively, lower electrode 106 is interpreted as claimed first electrode for it is connected to the negative terminal of a power supply; upper electrode 108 is claimed second electrode for it is connected to lower electrode 107 which is connected to a positive terminal of a power supply [0115].

10. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over MCKINNELL et al. (US 2004/0145049) and FUKUTANI et al. (US 2006/0032526) as applied to claims 21-23 above, and further in view of FLEURIAL et al. (US 2003/0047204).

MCKINNELL et al. and FUKUTANI et al. teach all the limitations of claims 21-23 but fail to teach a porous dielectric material comprises porous alumina; instead, the silicon oxide porous dielectric material taught by FUKUTANI et al. is formed by removing aluminum from the aluminum-silicon starting material [0025] [0028].

FLEURIAL et al. teach a thermoelectric device that operates to create energy based on temperature difference, or conversely, create a temperature difference based on applied energy. Said thermoelectric device contains a plurality of Bi_2Te_3 thermoelectric legs or thin nanoscale wires that are formed within a template of porous alumina [0012-0014] [0017].

Because both FUKITANI et al. and FLEURIAL et al. teach a nanowire containing thermoelectric device that creates energy based on temperature difference, one of ordinary skill in the art would have found it obvious to substitute the silicon oxide porous material of FUKITANI et al. for the porous alumina material of FLEURIAL et al. to achieve the predictable result of converting the temperature difference between electrodes to create electrical energy in an electronic device.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. MONTY et al. (US 6,849,911), GHOSHAL et al. (US 6,282,907), FLEURIAL et al. (US 2003/0041892), FLEURIAL et al. (US 7,098,393).

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bach T. Dinh whose telephone number is 571-270-5118. The examiner can normally be reached on Monday-Friday EST 7:30 A.M-5:00 P.M.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Barbara L. Gilliam can be reached on 571-272-1330. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Barbara Gilliam

bd

BARBARA GILLIAM
SUPERVISORY PATENT EXAMINER